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ABSTRACT

To those who look to technology to enhance a person's quality of life and not merely to restore capability, it is more important and cost effective to consider environmental modifications and the functions of devices within a comprehensive context of varying situations (Milieu characteristics); user interests, needs, capabilities, expectations, and goals (Person characteristics); and functions and limitations of the technology itself (Technology characteristics). This MPT Matching Person and Technology Model promotes consumer involvement and choice as well as student/parent/educator collaboration. When the variables within each of these three areas are organized according to the categories of device use (optimal and partial/relegant) and non-use (avoidance and abandonment), it is possible to determine whether some intervention or modification is needed for a person to gain maximum satisfaction and functional gain from use of the technology. To assist educators with the psychosocial and technical issues involved in matching students with technologies, a collaborative model has been developed which includes three consumer-oriented instruments: (1) Technology Overload Assessment (TOA); (2) Assistive Technology Device Predisposition Assessment (ATD PA); and (3) Educational Technology Predisposition Assessment (ET PA). Three examples illustrate use of educational technologies by hearing-impaired students--two pilot telecourses; the use of a hypercard stack in an existing lecture/discussion course; and adults' use and non-use of assistive listening devices (ALD)--and it is concluded that the ATD PA and ET PA seem to have done a good job of discriminating predispositions to technology use by satisfied and less satisfied users. (ALF)

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Matching the Student with the Most Appropriate Assistive Technology:

Evaluation of the Assistive Technology Device

Predisposition Assessment (ATD PA)

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Predisposition Assessment (ATD PA)*

The use of both educational and assistive technologies in a wide variety of educational settings has increased exponentially in the past few years. For example, IDEA, or Individuals with Disabilities Education Act of 1990 (formerly the Education of the Handicapped Act), now explicitly includes assistive technology as an area to be considered when developing a child's Individual Education Plan (IEP). This Act defines assistive technology devices as "any item, piece of equipment, or product system, whether acquired commercially off-the-shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities." The possible use of assistive technology devices must be considered along with the child's educational needs and the potential for technology to help meet such educational needs must be determined on an individual basis. Cost and/or lack of availability of equipment cannot be used as an excuse for denying an assistive technology service and parents have the right to appeal if assistive technology services are denied.

In addition to IDEA, Section 504 of the Rehabilitation Act of 1973, requires that postsecondary students must be provided "reasonable accommodations" and employees of educational institutions are protected under the Americans with Disabilities Act. The term "Reasonable accommodations" for persons with disabilities frequently means the provision of assistive technologies.

Instructional and educational technologies are often defined as: a) electromechanical or computerized means of instructional delivery (e.g. hypercard stacks, telecourses) or b) as the process of developing and designing instruction according to cognitive psychology and learning theory and, thus, technologies can range from what is written on the blackboard, to overheads and handouts, to hypercard stacks and telecourses. For the purposes of this paper, we are assuming the former definition and that educators desire to better match individuals with electromechanical or computerized technologies.

* Based in part on material in the forthcoming book, Living in the State of Stuck by M.J. Scherer (Brookline Books, Cambridge, MA).

In all levels of education, for students with or without disabilities, such educational technologies as computer tutors and telecourses have expanded the options for addressing individual students' particular learning styles and needs. Together with assistive technologies, it is becoming increasingly important to be able to understand the differences between those who are satisfied with and successfully employ technologies and those who avoid or abandon their use.

Often the distinctions between assistive and educational technologies become blurred. In spite of the increasing availability of assistive and educational technologies for students with disabilities, the integration of technology into educational settings is a complex and multi-faceted task. Most technologies are viewed as presenting as many challenges as benefits. Students, parents, and teachers differ in their knowledge of available technologies and the value they ascribe to them. Additionally, training in their proper use and maintenance is not guaranteed.

The following are examples of questions teachers have regarding the provision of devices/systems for students:

- a) Will the use of the assistive technology result in a significant increase in the student's performance? Will this offset the costs of assistive technologies?
- b) How can we be sure that our limited funds for technologies will result in "the most bang for the buck" – i.e. that technologies go to those students who will optimally use them?
- c) Will a technology for one student establish a barrier for another (e.g. a system relying on auditory output for a low vision person that can't be accessed by a hard of hearing individual)?
- d) Where can we get technical assistance and more information regarding assistive technologies and IDEA compliance?

Some special educators who do not perceive themselves as technically skilled may not only avoid learning about new technologies, but may downplay their usefulness and not present them as viable options. If they have had unpleasant experiences in introducing new technologies into the classroom,

or participated in too many overly technical workshops, they may have become soured on updating or broadening their technical skills. Special educators need exposure to and training with new technologies. They want to be helpful, but need support and information in how to best assist their current and future students. Places are needed where they can see technologies in use, can try them themselves, and can receive knowledgeable answers to their questions.

In addition to access to information on technologies, special educators may desire help in breaking down educational goals and objectives so that they can identify the actual needs to be addressed by technologies. Finally, educators in a given geographic area need to interact with one another about various instructional modifications so they can share their knowledge of options and alternatives.

Many students -- and their parents -- may have an aversion to and, hence, avoid technical "gadgets." Some equate devices with deviance, others are unwilling to request or to make accommodations. While many remain uninformed about the options available to them, others are not accustomed to being assertive and may hesitate to ask for the assistance to which they are entitled. And there are some who lack experience with cooperation and negotiation who feel that they should not be the ones to accommodate; the burden of any needed accommodation should fall to others. Students and their parents need to be involved in the selection of appropriate technologies and to be able to exercise choice in the selection process. Often, they need preparation for and training in technology use and applications.

Technologies are not used if other support services are not there. Peers, other teachers, the school administration, the student's other environments, must all be supportive of technology use. It is important to have the services and support necessary to the optimal utilization of assistive and other technologies.

The Need for A Collaborative Approach to Matching Persons and Technologies

There are two prevalent perspectives in operation today:

1. Individual deficit modification, which emphasizes the elimination or minimization of functional limitations (e.g. hearing loss, low vision). This is the intent behind personal assistive technologies as well as traditional special education and rehabilitation.
2. Environmental deficit modification, which focuses on environmental conditions under which people with hearing loss, low vision and other functional or sensory limitations can integrate. This is the intent of mainstreaming and A.D.A.

The economic costs of individual and environmental deficit modification may be high, but the emotional investment is low. An unfortunate state of affairs currently exists in which we are making widespread environmental accommodations and are creating more and better technologies that minimize the functional impact of a disability, yet we often fail to provide the more intangible, but essential and basic, opportunities for assimilation. While accessibility and enhanced functioning are important goals, as crucial, or more crucial, are an individual's basic needs for security, autonomy, affiliation, accomplishment, intimacy and identity. As outlined by Norris Hansell in his discussion of people's "essential attachments," individuals need to feel connected to the world in which they live – connected to other persons, connected to a social role, and to feel that they matter and that their lives are meaningful.

To those who look to technology to enhance a person's quality of life and not merely to restore or enhance capability, it is ultimately more important and cost effective to consider environmental modifications and the functions of devices within a comprehensive context of varying situations (Milieu characteristics); user interests, needs, capabilities, expectations, and goals (Person characteristics); and functions and limitations of the technology itself (Technology characteristics). This **MPT Matching Person and Technology Model** promotes consumer involvement and choice as well as student/parent/educator collaboration. It is also outcome-driven.

The MPT Model

Ideally, the matching of a person with a technology is a collaborative process. For this to be successful, both educators and students and their parents need guidance in making informed decisions about the use of technologies. They must be provided with up-to-date and accurate information and have the ability to exercise choice. They need exposure to technologies and to have the opportunity to try them on a trial basis in realistic situations.

There are many factors to consider when trying to match a person with technology. Regardless of the type of technology under consideration, an individual will either be a user or non-user of it. But people can vary within the categories of use/non-use: a) Use can be full-time and done willingly, or partial and done reluctantly (this most frequently occurs with persons whose device use is not optional or where a person will use a device in one environment but not another); non-use can be due to the avoidance of a device altogether (e.g. a person will not show up for a device evaluation or will not purchase it) or to its abandonment. It is also the case that a person can be in one category with one device at a particular point in time and be in another with a second device at the same point in time. A change in either the milieu, person or technology will most likely create change in the others. For example, the introduction of a new device can necessitate milieu changes, place new demands on the person, and make the use of an existing device more complicated or cumbersome. It is likely that as time goes on, device compatibility/incompatibility will be a growing area of concern since we've become aware that a "fatal threshold" can be reached where a system composed of one or more devices may have an additive effect resulting in a situation of frustration and "overload" for a person.

The reasons for varying use of assistive devices can be grouped into the three **MPT** areas as follows:

1. The characteristics of the **milieu** (environment and psychosocial setting) in which the device is used,
2. Pertinent features of the individual's **personality** and temperament, and
3. The salient characteristics of the **technology** itself.

When the variables within each of these three areas are organized according to the categories of device use (optimal and partial/reluctant) and non-use (avoidance and abandonment), we can try to profile where certain persons are at a particular point in time with a device (See Figure 1). For example, a person may look like a partial/reluctant user of a technology as far as the **Milieu**, but appear to be an optimal user according to the characteristics listed for **Personality** and **Technology**. Thus, the **Milieu** of use may need some intervention or modification for the person to gain maximum satisfaction and functional gain from use of the technology.

Assistive Technology Influences

		Milieu	Personality	Technology
U S E	Optimal	Support from family/peers/ employer Realistic expectations of family/ employer Setting/environment fully supports and rewards use	Proud to use device Motivated Cooperative Optimistic Good coping skills Patient Self-disciplined Generally positive life experiences Has the skills to use the device Perceives discrepancy between desired and current situation	Goal achieved with no pain, fatigue or stress Compatible with/enhances the use of other technologies Is safe, reliable, easy to use and maintain Has the desired transportability No better options currently available
	Partial/ Reluctant	Pressure for use from either family/peers/employer Assistance often not available Setting/environment discour- ages use or makes use awkward	Embarrassed to use device Unmotivated Impatient/impulsive Unrealistic expectations Low self-esteem Somewhat intimidated by technology Technology partially or occa- sionally fits with lifestyle Deficits in skills needed for use	Goal not fully achieved or with discomfort/strain Requires a lot of set-up Interferes somewhat with the use of other technologies Device is inefficient Other options to device use exist
N O N U S E	Avoidance	Lack of support from either family/peers/employer Unrealistic expectations of others Assistance not available Setting/environment disallows or prevents use	Person doesn't want it Embarrassed to use device Depressed Unmotivated Uncooperative Withdrawn Intimidated by technology Many changes required in lifestyle Does not have skills for use	Perceived lack of goal achievement or too much strain/discomfort in use Requires a lot of set-up Perceived or determined to be incompatible with the use of other technologies Too expensive Long delay for delivery Other options to device use exist
	Abandonment	Lack of support from either family/peers/employer Setting/environment discour- ages or makes use awkward Requires assistance that is not available	Embarrassed to use device Depressed Low self-esteem Hostile/angry Withdrawn Resistant Poor socialization and coping skills Many changes in lifestyle with device use Lacks skills to use device and training is not available	Goal not achieved and/or discomfort/strain in use Is incompatible with the use of other technologies Has been outgrown Is difficult to use Device is inefficient Repairs/service not timely or affordable Other options to use became available

To assist educators in the psychosocial and technical issues to consider when attempting to match a student with a technology, a collaborative model for matching persons with technologies has been developed (see Figure 2). Components of the model include the following consumer-oriented instruments:

1. Technology Overload Assessment (TOA) (Scherer & Weissberger, 1989)
2. Assistive Technology Device Predisposition Assessment (ATD PA) (Scherer & McKee, 1989)
3. Educational Technology Predisposition Assessment (ET PA)(Scherer, McKee & Young, 1990)

An earlier AERA paper (Scherer & McKee, 1991) discussed the value of integrating quantitative and qualitative methods using a Participatory Action Research design to develop instruments assessing the quality of the match between an individual and a particular technology being proposed for that person's use. With the exception of the TOA, the instruments are self-report checklists with a consumer form (items were identified by individuals with disabilities) and a version designed to be completed by professionals. The two versions allow for the assessment of shared perspectives. The primary purpose of the instruments, however, is to make sure consumer input drives the **Matching Person and Technology (MPT)** process.

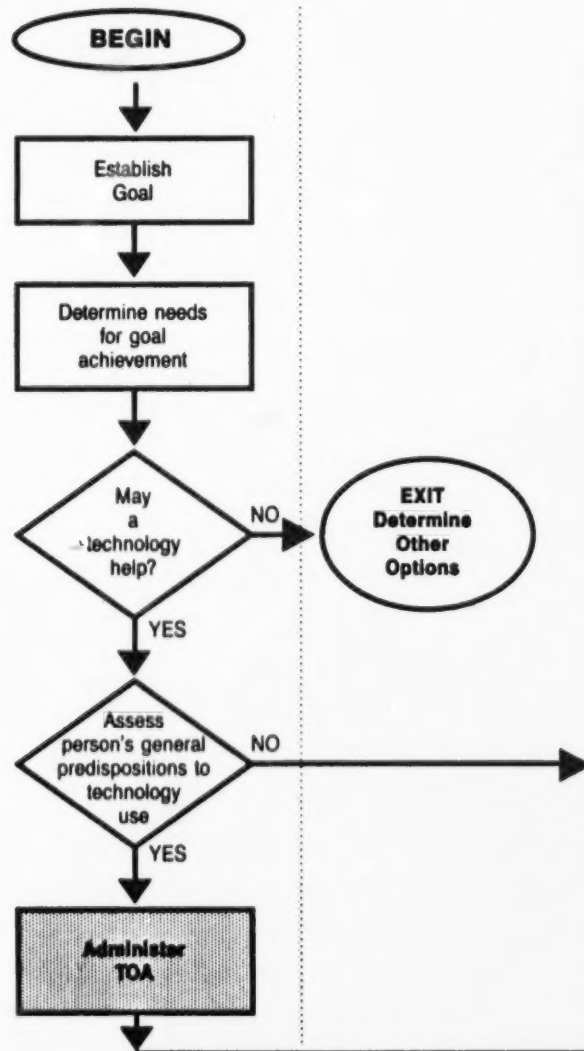
Other purposes are:

- a) to indicate areas where there may be difficulties in the individual's optimal use of a particular technology so that the necessary steps can be taken to intervene in a situation of potential mis-use or non-productive use and a reduction of the disappointment and frustration that often accompanies less than ideal use,
- b) to guide professionals/educators into considering all relevant influences on device use while focusing primarily on the student's quality of life and education, and
- c) to verify with other professionals/educators and consumers the existence and importance of the influences on assistive technology use that have been identified to date (particularly with elementary and secondary school students).

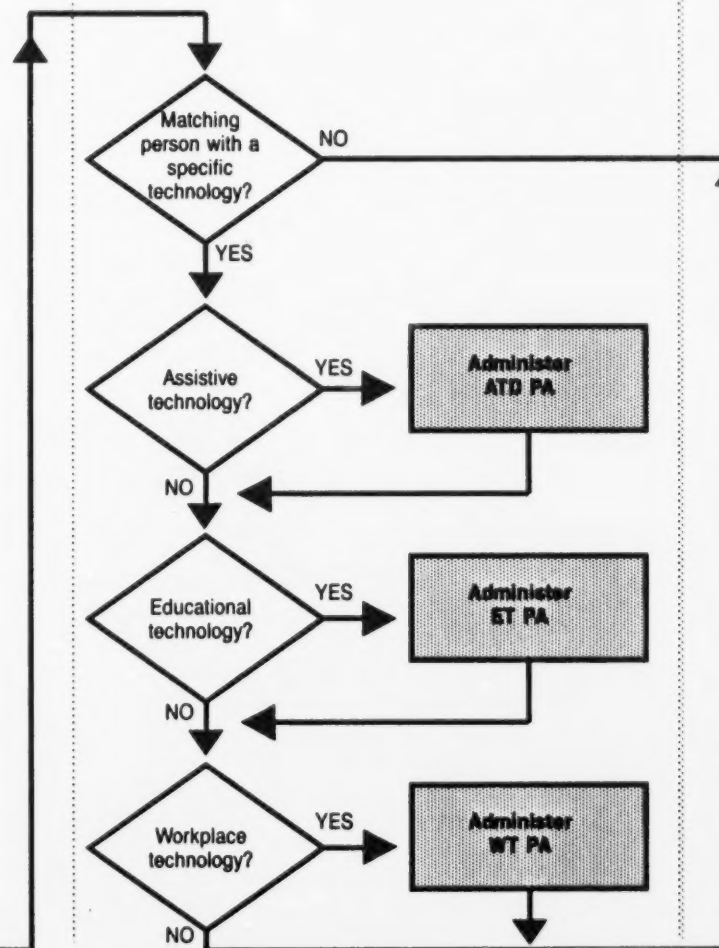
All instruments have a checklist format and are situational. They are currently in pilot form and are undergoing further refinement as information concerning their usefulness is collected across the U.S. and several European countries. Preliminary analyses on postsecondary and adults populations indicate that they have good criterion-related validity (since the items emerged from the actual experiences of users and non-users, they also have content validity) and that they have good inter-rater reliability. A detailed presentation and discussion of results of the preliminary analyses is found in Scherer and McKee (1992). A brief summary of the key findings follows:

A Collaborative Model for Matching Persons with Technologies

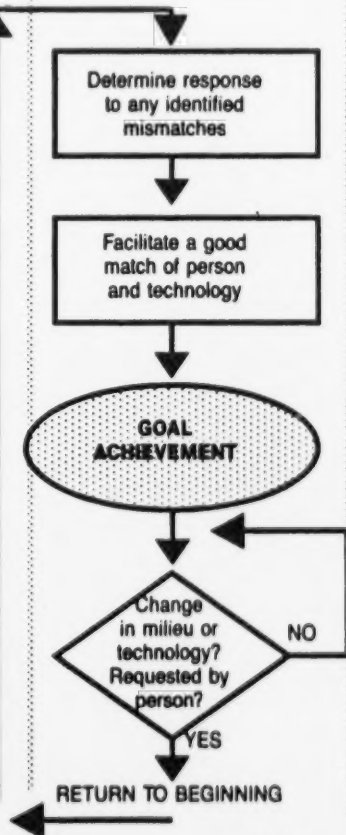
General Technology Relevance



Specific Technology and Person Matching



Match Quality and Follow-up



Hearing-Impaired College Students' Use of Educational Technologies:

- A. Two pilot telecourses were offered in the Fall of 1991 to students at Rochester Institute of Technology and Gallaudet University. The instructor for one of the courses was from RIT, and for the other course from Gallaudet. The instructional delivery involved videotaped lectures and class discussions via electronic mail. All assignments were read and graded through the use of electronic mail. At the end of the course, some students from each institution were interviewed with the ET PA content serving as the interview protocol.

Those deaf students in the telecourse who were least satisfied with the instructional delivery system said they prefer face-to-face discussions where they can watch facial expressions. Dissatisfied students also said that they are intimidated by computers, that computer use interferes with their social activities, and that they did not have the background skills for the course. None of the most satisfied students reported intimidation or social interference, and all said that they had the background skills for the course.

- B. A hypercard stack was created to augment an existing instructor-based, lecture/discussion course offered to first year science majors in need of improved study skills. The hypercard stack offers a self-paced method of instructional delivery. One module, Test Taking, was pilot tested with all 9 students enrolled in the Fall, 1991 science department Freshman Seminar. Evaluation sessions were conducted one-on-one and involved the students use of the hypercard stack. The computer screen was videotaped, showing cursor movements and choices as students moved through the stack. Following this, students completed a questionnaire that included the ET PA content.

While all students reported that the hypercard stack helped them learn "Test Taking" strategies and that they would use a similar mode of instruction again, those with the most satisfaction reported that they prefer working alone as opposed to working in a group, that they are often anxious, and that they generally see computer use as being fun. The least satisfied students reported just the opposite.

Adults Use and Non-use of Assistive Listening Devices (ALDs):

Members of the Rochester area organization "Self-Help for the Hard-of-Hearing (SHHH)" were asked to complete the ATD PA and six other instruments regarding their use of assistive listening devices. For the most part, people who are active in SHHH wear hearing aids and use a variety of ALDs. The mean age of the active members of this group is around 60.

The membership of an organization dedicated to the continuing education of older adults was also asked to complete the ATD PA and other instruments regarding their use of assistive listening devices. None of the individuals in this group wear hearing aids or use ALDs, but all have a demonstrated hearing loss. The mean age in this group of persons is approximately 65.

Comparisons of the members of SHHH and the members of the continuing education organization formed a "contrasted groups" design.

The members of SHHH and the continuing education organization, while similar in age, differ in degree of hearing impairment and need for ALDs, with the SHHH members having more hearing loss and need for assistive listening devices. In completing the battery of instruments, only two -- the ATD PA and the Communication Profile for the Hearing Impaired (Demorest & Erdman, 1984) -- showed significant group mean differences. The SHHH members reported a great deal of perceived benefit to device use, a belief that device use will enhance their quality of life, and a view of devices as important in achieving their goals. The members of the continuing education organization reported the opposite.

Conclusion

The ATD PA and ET PA seem to have done a good job of discriminating predispositions to technology use on the part of satisfied and less satisfied users.

As the use of assistive and educational technologies increase, there will be more concern directed towards their quality, selection, and the ways they impact overall quality of life. It is important to be able to analyze the constellation of factors serving to influence an individual's predisposition toward technology use or

non-use so that the most appropriate technology(ies) for that person can be provided. Based on results obtained to date, there are two self-report, easy-to-use checklist instruments available, both of which have reasonable validity and inter-rater reliability. The ATD PA and ET PA can be useful:

- in the earliest stages of matching a person with a technology by giving the consumer a means of providing direct input into the process of technology selection and making an informed choice,
- in identifying needed modifications in the technology,
- in reducing the frustration that often accompanies a poor match between individuals and the technologies meant to help them by providing criteria against which to assess the likelihood of satisfied technology use.
- and enabling persons to determine changes in predispositions to technology use over time.

Copies of the instruments as well as more complete descriptions of their development are available from the authors.

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